DOE IT Sustainability and Data Center Optimization - An Integrated Approach

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DOE Information Management Conference
April 18, 2012

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Presentation Overview

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- Strategic Context
- Background
- Partnerships
- Drivers, Goals and Objectives
- Reporting and Scoring
- Success Stories and Collaboration
- Current Initiatives

Sustainability Strategic Context

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E.O. 13514

"Federal Leadership in Environmental, Energy and Economic Performance"

DOE 2011 Strategic Plan

Transforming our Energy Systems

Leading the National Conversation on Energy - Make the Federal Government a Leader in Sustainability

Management and Operational Excellence

Achieving Operational and Technical Excellence - Leverage Infrastructure to Support the Mission

DOE Order 436.1 "*Departmental Sustainability*"

DOE Strategic Sustainability Performance Plan

DOE Background

Second largest user of facility energy in the Federal Government

In FY 2010, DOE used, occupied and emitted approximately:

- **30 trillion Btus energy; 3% of Government total**
- **5.2 million MWH electricity; 9% of Government total**
- **7.4 billion gallons of potable water; 4% of Government total**
- **129 million square feet; 4% of Government total**
- **4.0 million $MTCO_2e$ Scope 1& 2 GHG; 8% of Government total**

Federal Government Energy Progress

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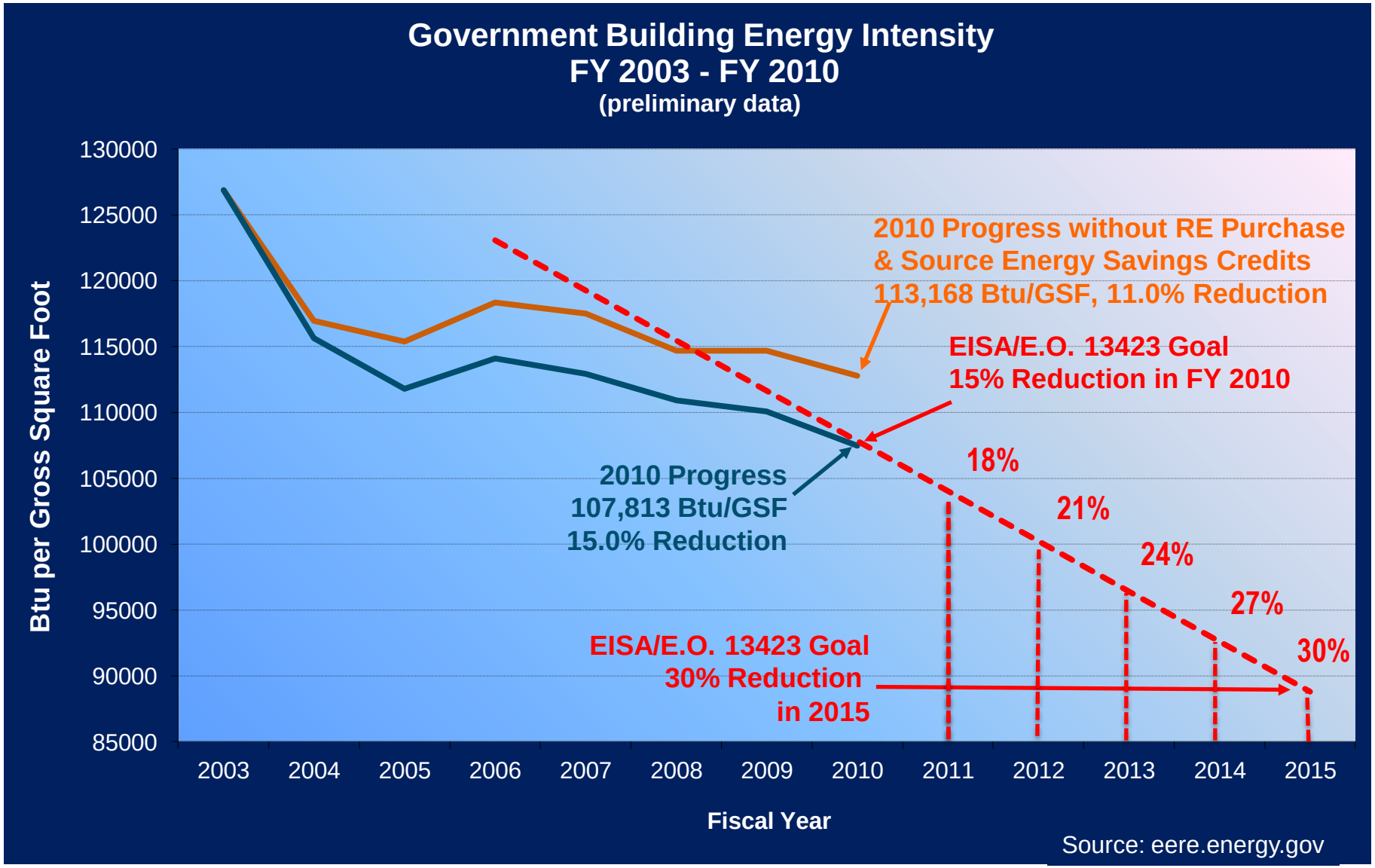

Source: eere.energy.gov

Sustainability Performance Office (SPO)

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- Reports to SSO as the lead for DOE sustainability
- Collaborates with partners throughout DOE
- Coordinates Departmental sustainability efforts
- Implements the SSPP with partners and sites
- Provides corporate oversight
- Works to change behavior
- Evaluates performance and reports on sustainability through validated data and scorecards
- Lead for work with OMB/CEQ and other Federal agencies on sustainability matters

Corporate Partners

- Office of Management
  - Fleet
  - Headquarters Administration
  - Procurement
  - OECM
- Chief Information Officer
  - Data center consolidation
  - Green IT
- Health, Safety and Security
  - Pollution prevention
- Policy and International
  - Climate Change Adaptation
  - Clean Energy Ministerial
- Chief Financial Officer

DOE Order 436.1

Consolidates DOE Orders "*Departmental Energy, Renewable Energy, and Transportation* "(430.2B) and "*Environmental Protection Program" (450.1A)*

Establishes SPO as the Office of Primary Interest

Requires implementation of:

- **Strategic Sustainability Performance Plan (SSPP)**
- **Site Sustainability Plans (SSPs)**
- **Environmental Management Systems (EMSs)**

Interconnected Goals

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DOE has over a dozen main sustainability goals mandated by Statute and Executive Order

Investment in one goal can reap rewards in other goals

Goals are not silos but are more like a web

Sustainability Web places focus on interconnected goals

Sustainability Web

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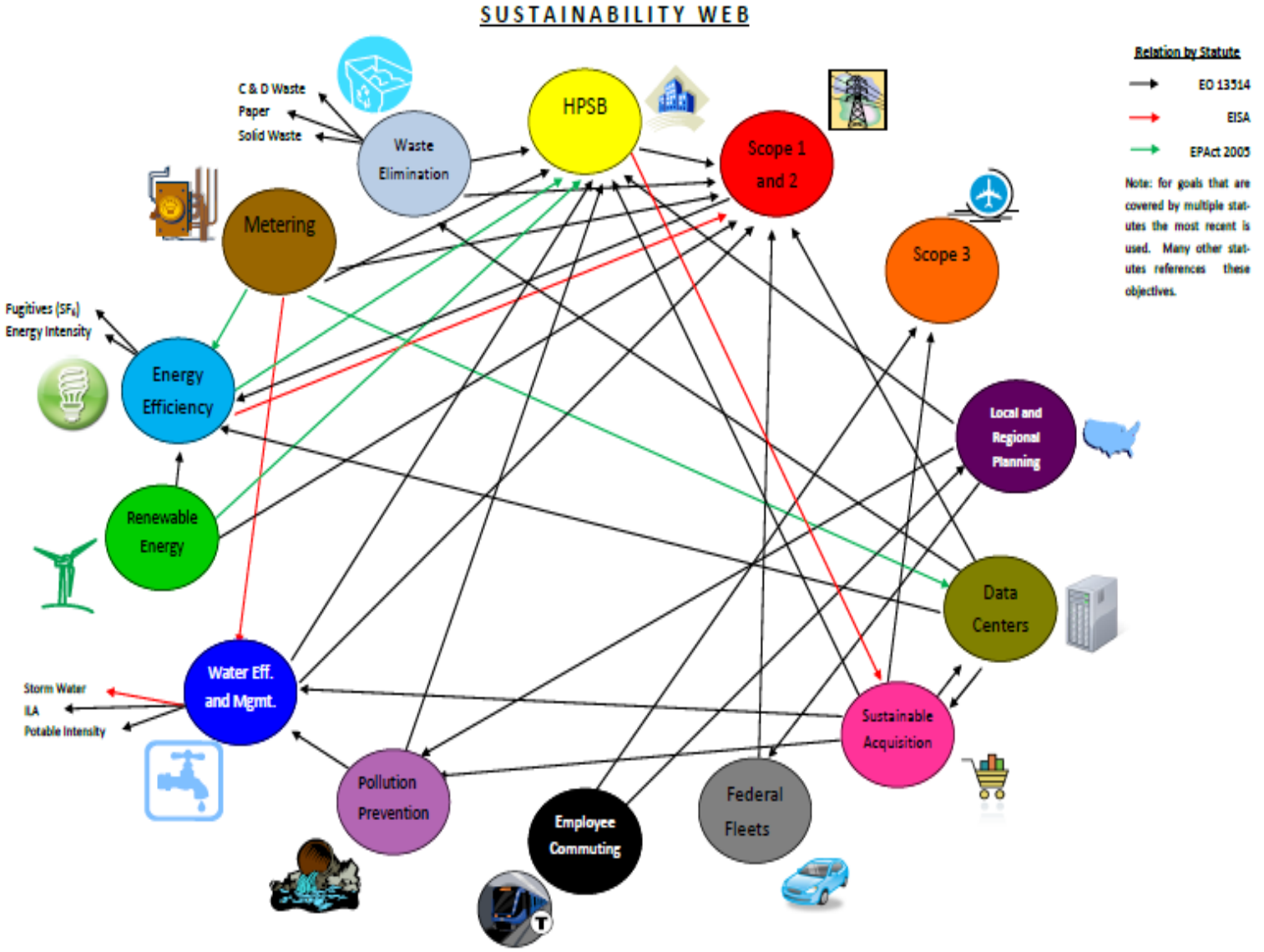

2011 SSPP: Goal 7

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Goal 7 DOE Planning Table

ELECTRONIC STEWARDHIP & DATA CENTERS	Unit	FY 10	FY 11	FY 12	FY 13	FY14	FY15
% of electronic product acquisition covered by current Energy Star specifications that must be energy-star qualified	%	100%	100%	100%	hold	hold	hold
% of covered electronic product acquisitions that are EPEAT-registered	%	92%	95%	95%	hold	hold	hold
% of covered electronic product acquisitions that are FEMP-designated	%	95%	95%	95%	hold	hold	hold
% of agency, eligible PC, Laptops, and Monitors with power management actively implemented and in use	%	92%	95%	100%	100%	hold	hold
% of agency, eligible electronic printing products with duplexing features in use	%	85%	95%	100%	100%	hold	hold
% of electronic assets covered by sound disposition practices	%	99%	100%	100%	100%	hold	hold
% of agency data centers independently metered, advanced metered, or sub-metered to determine monthly (or more frequently) Power Utilization Effectiveness (PUE)	%	18%	40%	60%	80%	90%	100%
Reduction in the number of agency data centers	#	1	1	2	0	1	1
% of agency data centers operating with an average CPU utilization greater than 65%	%	16%	50%	100%	hold	hold	hold
Maximum annual weighted average Power Utilization Effectiveness (PUE) for agency	#	1.82	1.8	1.7	1.6	1.5	1.4
% of agency data center assigned a certified Data Center Energy Practitioner	%	n/a	50%	100%	100%	100%	100%
% of agency data centers that have conducted annual DC-Pro energy assessment	%	n/a	50%	100%	100%	100%	100%

OMB/CEQ Scorecard

Sustainability / Energy Scorecard

DOE Planned Actions, Jan. 2012:

- **Implement 100% power management**
- **Improve reporting of non-eligible mission critical scientific and security equipment.**

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Energy Efficient High Performance Computing (HPC) Working Group

Purpose: To drive implementation of energy conservation measures and energy efficient design in high performance computing (HPC).

Goals:

- Reduce expenditure and curb environmental impact through increased energy efficiency in HPC centers.
- Encourage the HPC community to lead in energy efficiency as they do in computing performance.
- Develop and disseminate best practices for maximizing energy efficiency in HPC facilities and equipment.
- Serve as a forum for sharing of information (peer-to-peer exchange) and collective action.

http://eehpcwg.lbl.gov/home

Reporting

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CIO/SPO are working to consolidate and simplify reporting

FY 2011: CEDR (Consolidated Energy Data Report)

- 2011 report contained numerous data quality issues and follow-up activities are required to resolve open questions.

Moving to DOEGRIT

2011 Site Highlights

LANL - Implemented IaaS (IOD) virtualization service. Cold-aisle containment at their LDCC data center.

LLNL - Implemented ASHRAE best practices in 10 of their data centers. LLNL has two LEED certified buildings containing data centers.

Pantex - Established hot/cold aisles in their data center. Upgraded from 110v supply to 208v to reduce line loss. Replaced legacy mainframe with blade servers. Power consumption has been reduced by the virtualization of 185 physical servers.

SNL - Sandia is replacing their legacy copper network with advanced fiber. It is expected to reduce network related power & O&M cost by up to 75%. They also have increased the CRAC cooling temperatures from 58 degrees F to 65 degrees in data centers 725 & 880A.

SRS - Promoting tele-meeting practices via remote meeting software and Citrix Open Internet. LBNL conducted two site data center assessments resulting in the implementation of significant energy conservation ECMs and power savings.

2011 Site Highlights

PNNL – Implemented under floor cable removal, replacement of two old UPS's with an high performance UPS, elimination of a 125V transformer and associated power losses by distributing 480V directly to the computer rows in data center ISB2 Room 1. They are also using rear door heat exchangers to cool high density high performance computing in CSF Room 1811 data center. "Free" cooling for the chilled water system is provided by an aquifer heat exchanger without the need of any mechanical compressors.

SLAC - A pilot program to increase the efficiency of the airflow in the Computation Center was initiated with the installation of cold-aisle containment doors on two rows of server racks. In addition, ten water cooled racks were installed that are capable of efficiently cooling high density servers (~30 KW per rack).

NREL - NREL delivers its administrative IT products and services from its "world-class" energy-efficient data center located in the RSF. This facility has achieved a LEED Platinum rating and net-zero energy consumption (dependent on season) even with the inclusion of a energy-intensive data center..

Fermi Lab – Implemented Hot/Cold aisles, cold aisle containment, blanking and threshold panels, warmer cold aisle temperatures, removed under-floor cabling, sensor based air management controls, and high efficiency UPSs to reduce the infrastructure energy footprint of their data center.

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FDCCI

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In February 2010, the Administration launched the Federal Data Center Consolidation Initiative (FDCCI) with the goal to reverse the historic growth of Federal data centers and leverage best practices from the public and private sector to:

- **Promote the use of Green IT by reducing the overall energy and real estate footprint of government data centers;**
- **Reduce the cost of data center hardware, software and operations;**
- **Increase the overall IT security posture of the government; and,**
- **Shift IT investments to more efficient computing platforms and technologies.**

The OCIO supports the Departments effort in supporting the FDCCI program first as an independent effort, then combined with the Department's sustainability efforts, as specified in the DOE Strategic Sustainability Performance Plan (SSPP), Goal 7 "Electronic Stewardship and Data Centers".

No.	Agency Component	Data Center	Location	Action to be taken	Action Date
1	EE	Forrestal 1	Washington, DC	Consolidation	Q3 / 2012
2	EIA	Forrestal 2	Washington, DC	Consolidation	Q4 / 2013
3	IM	ESC-West	Albuquerque, NM	Consolidation	Q3 / 2012
4	LM	Mound Office	Miamisburg, OH	Consolidated	Q3 / 2011
5	OCRWM	Hillshire	Las Vegas, NV	Consolidated	Q3 / 2011
6	OCRWM	Sahara	Las Vegas, NV	Decommissioned	Q2 / 2010

DOEGRIT

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The DOE IT Sustainability Dashboard (DOEGRIT) is a tool that sits at the crossroads of compliance -based initiatives and addresses the following business needs for Federal agencies:

- **Reduce the burden of data calls on IT and facility managers,**
- **Quickly and accurately estimate the PUE of agency data centers**
- **Support prioritizing the consolidation and closure of data centers through quantifiable measures,**
- **Automate the creation of the Sustainability and Energy Scorecards.**

The DOEGRIT system has three major services,

- **The DC Pro Assessment**
- **Total Cost of Ownership Estimations and an**
- **IT Best Practices Self Assessment**

For the purpose of meeting the SSPP requirements, only the DC Pro assessment is required. The DOEGIRT system is pre-populated with information from previous CEDR and FDCCI data calls. The site user should verify that any data centers listed are still valid and annotate additional data centers as required. If a Site data center has an existing ITP DC Pro assessment, this assessment can be imported into DOEGIRT.

HQ ESPC Data Center Project

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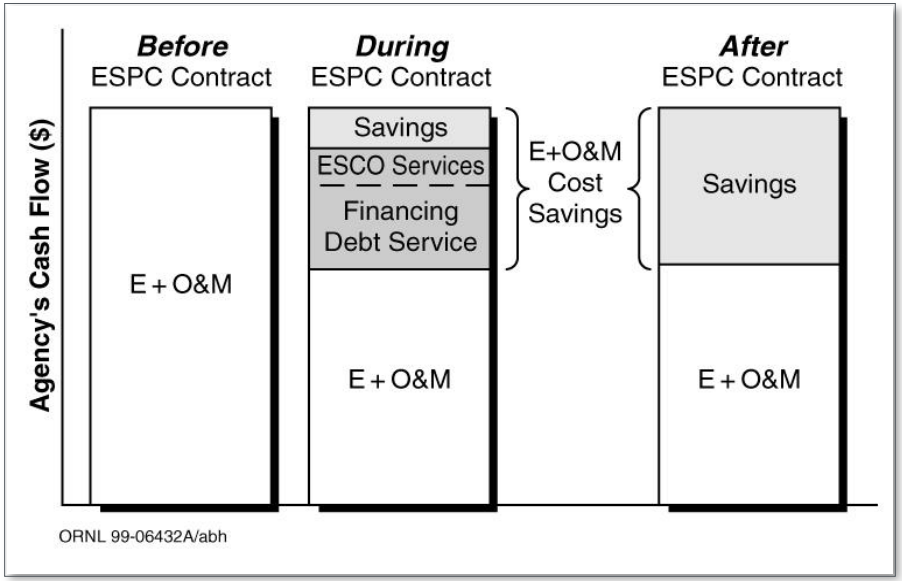
An Energy Savings Performance Contract (ESPC) is a method of financing energy efficiency improvements in which the cost savings generated by installed conservation measures are used to pay all financing and investment costs for the project.



The HQ ESPC Data Center project has two major objectives;

- **Evaluate the use of an ESPC contract to support data center consolidations and IT infrastructure transformation**
- **To conduct a pilot ESPC effort at HQ to consolidate HQ data centers and IT systems, relocate the EITS ABQ data center, and fast tract implementation of next generation IT services.**

Energy Conservation Measures (ECMs) Projects (Phase 1)

- ESC-West (Albuquerque) Relocation activities
- Implementation of Thin Client for Headquarters and for DOENet
- VOIP for Headquarters
- Printer Replacement for DOENet
- Germantown Data Center optimization / consolidation

Energy Conservation Measures (ECMs) Projects (Phase 2)

- Software as a Service (SaaS) for email
- SaaS for eDiscovery
- SaaS for Portal / Social Network
- VTC Standardization
- EM Sites Data Center Consolidation

Sustain*IT* Integrated Capabilities

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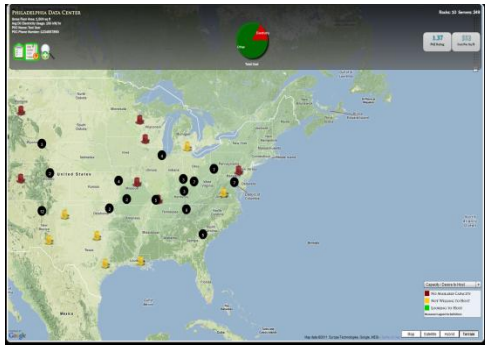
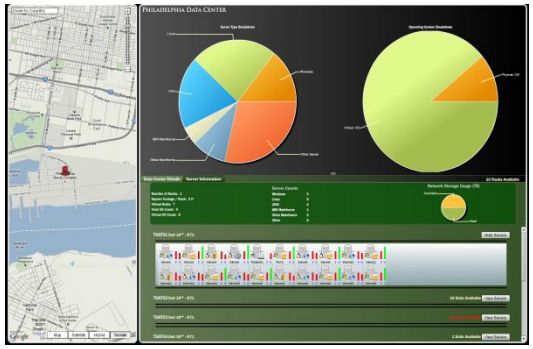
YOURCLOUD

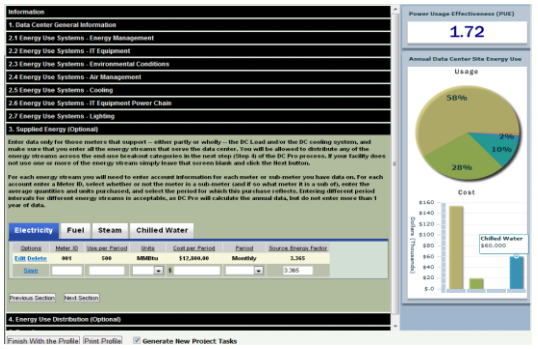
KILOWATT HOURS 188320 saved per year



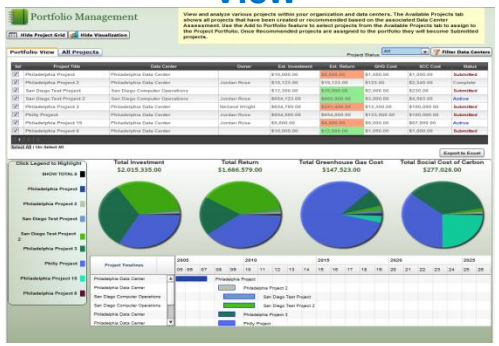
Data Center High-Level View



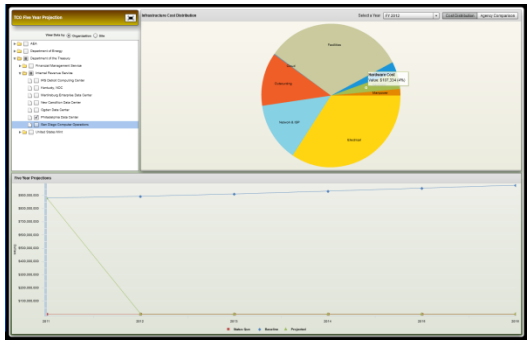
Data Center Detail View



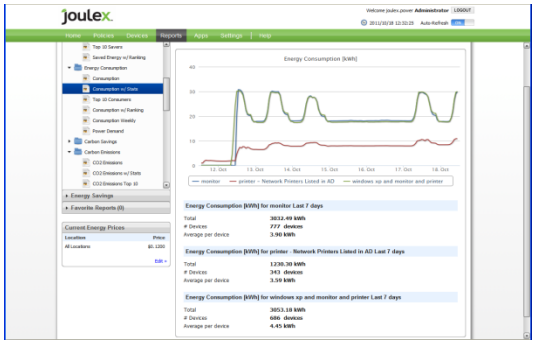
DC Pro Analysis



Sustainable Portfolio Project Manager



Facility TCO Modeling



Real-time Energy Monitoring and Management

Questions and Comments